

A FULL DUPLEX INDOOR WIRELESS COMMUNICATION SYSTEM

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ABSTRACT

This paper about the full duplex indoor wireless communication system using MATLAB tool .In this experiment it consists of duplex system which is a two connected device that communicate with one another in both directions simultaneously. It was on optical domain which uses a single mode fiber (SMF) for transmission and reception. It is simplified using MATLAB software and instead of using (SMF) transmission is carried through AWGN channel which work similar to the (SMF). It consist of transmitter and receiver, where typically a frequency of (10^9) which is modulated using digital modulation technique is transmitted through AWGN channel and received at the receiver, where demodulating the signal to obtain it into original form of signal. A feedback is then sending from receiver to transmitter which is monitored by Data centre. It is a centre which keeps tracking the information send and receives between transmitter and receiver. BER of both transmitter and receiver is checked to analyze the output obtained at receiver is same as that of transmitter. If the obtained output is found mismatched then transmitter resend the data bits to receiver for correction, At receiver side viterbi decoding algorithm is used to correct the error and resend it back to transmitter as a matched output.

KEYWORDS: Full Duplex Communication, System Structure, Software Tool, Bit Error Rate

INTRODUCTION

A duplex communication is a point to point system composed of two connected Parties or devices that can communicate with one another in both directions simultaneously. A full duplex (FDX) system called a double duplex system unlike half duplex it allows simultaneously but they transmit at such a higher rate of speed appears to be full duplex. There are several benefits to using full duplex over half duplex as the full data capacity is available in both the direction because the send and receive functions are separated, stations do not have to wait until their transmission, since there is only one transmitter for each which will improves the efficiency rate of the system. Digital modulation technique like QAM and BPSK is used for performing this communication. It become simpler using software instead of hardware as software gives the accurate information about the amount of data which is transmitted and the amount of data received which also reduced the handling of hardware and cost. It gives the comparison between Transmitter and receiver.

SYSTEM MODEL

It gives the overview of our proposed model and its operation flow that is shown in Figure 1

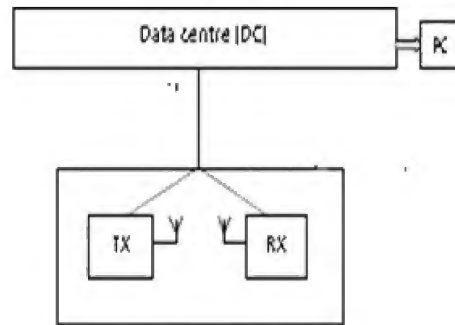


Figure 1

In the above figure it shows data centre which keeps tracking the transmission and reception of transmitter and receiver. Data center can store data in PC.

IMPLEMENTATION

It describe about the procedure of transmission and reception which is shown in Figure 2

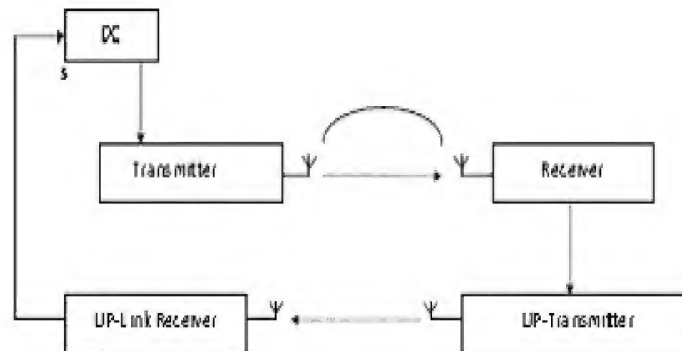


Figure 2

Figure shows data bits from Data centre which is transmitted through the AWGN channel and received at the receiver. Transmitter and Receiver are divided into several stages.

Transmitter Section

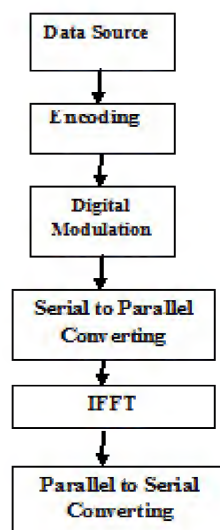


Figure 3

In this section data source is first encoded by encoder which comprises of CC and CRC. CRC is an error detecting code used in a digital network to detect the sudden changes to the data source. Blocks of data entering in the system get a short check value attached on retrieval the calculation is repeated and corrective action is taken against presumed data if the check value not matched. CRCs are based on the theory of cyclic error-correcting codes that uses cyclic codes which encode message by adding a fixed length check value for the purpose of error detection in communication. cyclic codes are not only simple to implement but have the benefit of being particularly used for detection of burst errors. Typically an n -bit CRC applied to a data block of arbitrary length will detect any single error burst not longer than n bits and will detect a fraction of $1-2^{-n}$. The encoded bits is then given to digital modulation usually used QAM and BPSK,

Quadrature amplitude modulation (QAM) is both an analog and digital scheme which conveys a analog or digital bit stream by changing the amplitude of two carrier signal using amplitude shift keying (ASK) or amplitude modulation (AM), the two carrier usually out of phase with each other by 90° and thus called a Quadrature carriers, whereas PSK is a digital modulation scheme that conveys data by changing or modulating the phase of reference signal. BPSK is the simplest form of phase shift keying (PSK) which uses two phases which are separated by 180° and so called term 2-PSK. BPSK is functionally equivalent to 2-QAM modulation, then the modulating signal is then converted using serial to parallel converter it is given to IFFT block which will perform the inverse fast Fourier transform operation and then again it converted back into serial form and transmitted through AWGN Channel shown in Figure 4.

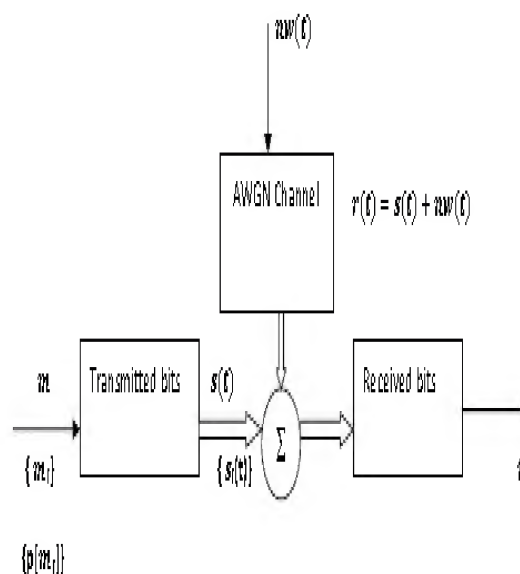


Figure 4

Additive white Gaussian noise (AWGN) is a channel mode in which the impairment to communication is a linear addition of wideband or white noise with a constant spectral density and a Gaussian distribution of amplitude. AWGN is commonly used to simulate background noise of the channel. It act as a medium between transmitter and receiver, the output of AWGN is converted into parallel form by serial to parallel converter then FFT operation is performed to obtained into the original form of data bit streams which is the converted into serial form by parallel to serial converter which is given to digital modulation which will sampled the signal and thus the sampled is then fed to decoder to obtained into original form of signal where data centre it will compare the signal received at the receiver with the transmitted bits, if the data which is send is different at the output error is occurred which is corrected using viterbi algorithm At the receiver which will find the error and correct it to obtained the original bits. The receiver section is a shown in the Figure 5

Receiver Section

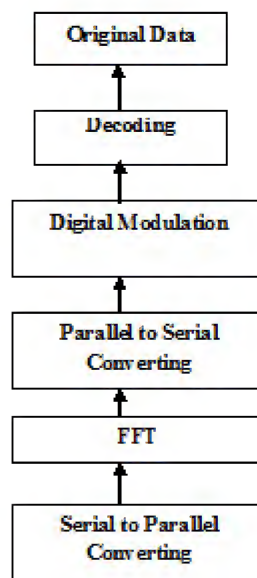


Figure 5

It describe about uplink and downlink transmitter and receiver which shows on the Figure 6 and Figure 7

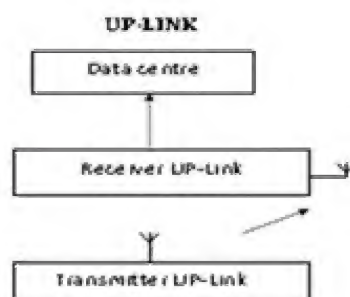


Figure 6

When a data is transmitted from transmitter it act as an uplink transmitter and receiver which received as an uplink receiver and given to data centre.

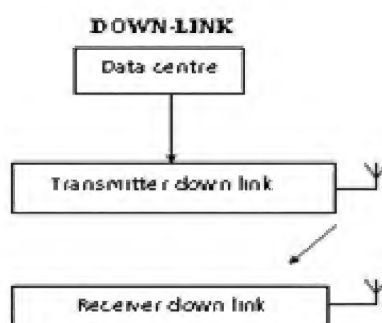


Figure 7

It is said to downlink transmitter and receiver once datacenter has checked the data it send a feedback from downlink transmitter to receiver.

SOFTWARE TOOL

Tool used to perform this communication is MATLAB is software that makes it possible for transmitting a data and receiving the data very easily without any complication and use of hardware. MATLAB can perform much operation, and it allows matrix manipulation, plotting of functions and data implementations of algorithm, creation of user interface. It is built around MATLAB language which includes code in the command window or executing text files containing codes including scripts and functions. MATLAB has structure data type. Since all the variables are arrays where each element of the array has the same field names. It supports developing applications with graphical user interface, using this tool separate codes are generate for each transmitter and receiver section, as analyzing both the transmitter and receiver as well checking BER which is the number of bits error is the number of received bits of a data stream over a communication channel that have been altered due to noise interference so the Bit error rate (BER) is the number of bit error divided by the total number of transmitted bits .It is expressed as shown

$$BER = \frac{1}{2} \text{erfc}(\sqrt{Eb/No})$$

As a result it analyze both output, if it found incorrect it will request to resend the data with correct bits. This process will continue till both transmitter and received bits matched with each other. It is then compared through graph analysis.

CONCLUSIONS

Thus through this experiment is a easy way to make using a fundamental part of optical and converting its platform using MATLAB Tool and transmitted wirelessly, at both transmitter and receiver side output had been checked which should be the same .This experiment which will make it very simple transmission instead of using OFC cable, as well as analysis is of both transmitter and receiver is done in a very simple way.

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